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DO 1-4, 11, 13, 14

UNIT 16 – NUCLEAR CHEMISTRY

BALANCING NUCLEAR REACTIONS WORKSHEET

Predict the missing product or reactant in the following nuclear reactions. Determine the type of nuclear reaction (α emission, β emission, γ emission, positron emission, artificial transmutation, fission, or fusion) described.

1.) $^{42}_{19}K \rightarrow {}^{0}_{-1}e + {}^{42}_{20}Ca$

2.) $^{239}_{94}Pu \rightarrow {}^{4}_{2}He + {}^{235}_{92}U$

3.) $^{235}_{92}U \rightarrow {}^{4}_{2}He + {}^{231}_{90}Th$

4.) $^{1}_{1}H + {}^{3}_{1}H \rightarrow {}^{4}_{2}He$

5.) $^{6}_{3}Li + {}^{1}_{0}n \rightarrow {}^{4}_{2}He + {}^{3}_{1}H$

6.) $^{27}_{13}Al + {}^{4}_{2}He \rightarrow {}^{30}_{15}P + {}^{1}_{0}n$

7.) $^{9}_{4}Be + {}^{1}_{1}H \rightarrow {}^{6}_{3}Li + {}^{4}_{2}He$

8.) $^{37}_{19}K \rightarrow {}^{0}_{+1}e + {}^{37}_{18}Ar$

9.) $^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{142}_{56}Ba + {}^{91}_{36}Kr + 3\,{}^{1}_{0}n$

10.) $^{238}_{92}U + {}^{4}_{2}He \rightarrow {}^{241}_{94}Pu + {}^{1}_{0}n$

11.) $^{14}_{6}C \rightarrow {}^{14}_{7}N + {}^{0}_{-1}e$

12.) $^{187}_{75}Re + {}^{2}_{1}H \rightarrow {}^{188}_{75}Re + {}^{1}_{1}H$

13.) $^{22}_{11}Na + {}^{0}_{-1}e \rightarrow {}^{22}_{10}Ne$

14.) $^{218}_{84}Po \rightarrow {}^{214}_{82}Pb + {}^{4}_{2}He$

15.) $^{253}_{99}Es + {}^{4}_{2}He \rightarrow {}^{1}_{0}n + {}^{256}_{101}Md$

Type of Nuclear Reaction

1.) Beta

2.) Alpha

3.) Alpha

4.) Fusion

5.) ---

6.) ARTIFICIAL TRANS

7.) Alpha

8.) Positron

9.) Fission

10.) ARTIFICIAL TRANS

11.) BETA

12.) ARTIFICIAL TRANS

13.) ---

14.) Alpha

15.) Art trans

UNIT 16 – NUCLEAR CHEMISTRY

DO 1-8

HALF-LIFE PROBLEMS WORKSHEET

1.) What is the half-life of a 100.0 g sample of nitrogen-16 that decays to 12.5 grams in 21.6 seconds?

$\frac{100}{2} = \frac{50}{2} = \frac{25}{2} = 12.5$ (1, 2, 3)

$3\sqrt{21.6} = 7.2\text{ s}$

2.) All isotopes of technetium are radioactive, but they have widely varying half-lives. If an 800.0 gram sample of technetium-99 decays to 100.0 g of technetium-99 in 639,000 years, what is its half-life?

$\frac{100}{800} = \frac{1}{8} = 3$ HALF LIVES

$3\sqrt{639{,}000} = 213{,}000$ yrs

3.) A 208 g sample of sodium-24 decays to 13.0 g of sodium-24 within 60.0 hours. What is the half-life of this radioactive isotope?

$\frac{13.0}{208} = \frac{1}{16} = 4$ H.L.

$4\sqrt{60.0} = 15.\text{ hrs}$

4.) If the half-life of iodine-131 is 8.10 days, how long will it take a 50.00 g sample to decay to 6.25 g?

$\frac{50}{2} = \frac{25}{2} = \frac{12.5}{2} = 6.25$ (1, 2, 3)

$8.10\text{ days} \times 3 = 24.3\text{ days}$

5.) The half-life of hafnium-156 is 0.025 seconds. How long will it take a 560 g sample to decay to one-fourth of its original mass?

$\frac{1}{4} \Rightarrow 2$ H.L.

$0.025 \times 2 = 0.05\text{ s}$

6.) Chromium-48 has a short half-life of 21.6 hours. How long will it take 360.00 g of chromium-48 to decay to 11.25 g?

$\frac{360}{2} = \frac{180}{2} = \frac{90}{2} = \frac{45}{2} = \frac{22.5}{2} = 11.25$ (1, 2, 3, 4, 5)

$21.6 \times 5 = 108$ HRS

7.) Potassium-42 has a half-life of 12.4 hours. How much of an 848 g sample of potassium-42 will be left after 62.0 hours?

$12.4\sqrt{62}$ (5)

$2^5 = 32$

$32\sqrt{848} = 26.5\text{ g}$

8.) Carbon-14 has a half-life of 5730 years. How much of a 144 g sample of carbon-14 will remain after 1.719×10^4 years?

$5730\sqrt{17190}$ (3)

$\frac{144}{2} = \frac{72}{2} = \frac{36}{2} = 18\text{ g}$ (1, 2) OR $8\sqrt{144}$

9.) If the half-life of uranium-235 is 7.04×10^8 years and 12.5 g of uranium-235 remain after 2.82×10^9 years, how much of the radioactive isotope was in the original sample?

$7.04 \times 10^8\sqrt{2.82 \times 10^9}$ (4)

$\frac{12.5}{2} = \frac{6.25}{2} = \frac{3.125}{2} = \frac{1.56}{2}$

$= 0.78\text{ g}$